A Non-Intrusive Radar-Based Vibration Sensor

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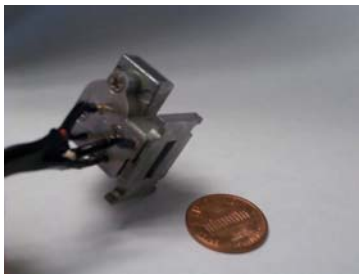
The radio frequency (RF) vibrometer is a new application of Radar technology that can be used to measure oscillatory motion of radar reflective objects. This device is similar to laser vibrometers in some capabilities, but is comparatively 100 times more inexpensive. This technology also has unique characteristics that offer a clear performance advantage over other vibration sensors in some applications. Such a sensor has applications in many areas of vibration measurement now dominated by laser vibrometers, accelerometers, and eddy-current/proximity probes. Such applications include: traditional bearing/gearbox vibration sensing, machine tool chatter detection, and gas turbine engine vibrations.

This invention has several key capabilities that provide an advantage over existing sensor technologies: 1) the sensor is non-intrusive, 2) it is unaffected by interference that can plague other sensors, and 3) it is capable of accurately measuring vibrations deep within a mechanism that are currently unable to be measured.

A prototype RF vibrometer has been constructed and tested concurrently with a high quality accelerometer on a bearing test stand located in the Georgia Tech Manufacturing Research Center. These initial tests have shown the potential of the RF vibrometer concept and provided a foundation for further sensor development and refinement.

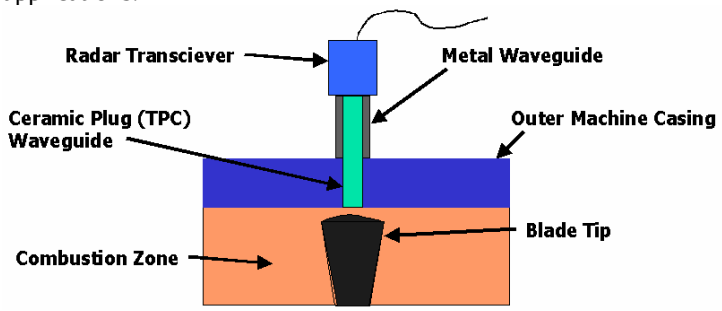


A Prototype Vibrometer Device used to measure vibration shown here next to a penny.

Recently, this technology has also received some interest for use in terrain measurement in automotive applications. The radar vibrometer provides excellent information on the road ahead of the wheel to provide advance knowledge of road conditions before the vehicle arrives.

Further experimental work is ongoing with the aid of a commercialization grant from the Georgia Tech Advanced Technology Development Center (ATDC). Georgia Tech is now seeking industrial funding partners for development of the technology. The chief objective of these efforts are to find the best applications for technology with a high market potential.

The immediate objective of this research work is in testing the performance limits of the sensor system in order to understand the breadth and depth of potential market applications.



Possible applications include "piping" the signal to areas of interest deep inside hostile environments such as combustion zones, without wires.

Scott is responsible for coordinating PMRC activities, and is a common contact point for the industrial sponsors within the research group. His area of expertise are in the areas of: software-based instrumentation, vibration diagnostics, condition based maintenance, cost justification for technology improvements in manufacturing, and new sensor development. In addition, Mr. Billington has been involved with projects in the areas of controls, metrology, machining, hard turning, computer aided design, and materials characterization. He received his M.S. degree from Georgia Tech in 1997 and is completing is MBA in the fall of 2001.

To learn more about this research at Georgia Tech, please visit the website: http://www.radatec.com

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